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DEPARTMENT OF LABOR

Occupational Safety and Health Administration

[Docket No. OSHA-2022-0007]

McNally/Kiewit Joint Venture: Grant of Permanent Variance

AGENCY: Occupational Safety and Health Administration (OSHA), Labor.

ACTION: Notice of Permanent Variance.

SUMMARY: In this notice, OSHA grants a permanent variance to McNally/Kiewit Joint Venture (McNally) related to work in compressed-air environments.

DATES: The permanent variance specified by this notice becomes effective on [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER] and shall remain in effect until the completion of the Shoreline Storage Tunnel project or until modified or revoked by OSHA.

FOR FURTHER INFORMATION CONTACT: Information regarding this notice is available from the following sources:

Press inquiries: Contact Mr. Frank Meilinger, Director, OSHA Office of Communications, phone: (202) 693-1999; email: *meilinger.francis2@dol.gov.*

*General and Technical Information***:** Contact Kevin Robinson, Director, Office of Technical Programs and Coordination Activities, Directorate of Technical Support and Emergency Management, Occupational Safety and Health Administration, U.S. Department of Labor; phone: (202) 693-2110 or email: *robinson.kevin@dol.gov*.

SUPPLEMENTARY INFORMATION:

Copies of this Federal Register notice: Electronic copies of this *Federal Register* notice are available at *http://www.regulations.gov*. This *Federal Register* notice and other relevant information are also available at OSHA's webpage at *http://www.osha.gov*.

I. Overview

On November 12, 2021, OSHA received a variance application submitted by letter from McNally/Kiewit joint venture ("McNally" or "the applicant") regarding the Shoreline Storage Tunnel project, which consists of boring a 12-foot diameter tunnel under a subaqueous roadway in Cleveland, Ohio. McNally requested a permanent variance from several provisions of 29 CFR 1926.803, the OSHA standard that regulates construction work in compressed air environments. Specifically, McNally sought a variance from the provisions of the standard that: (1) prohibit compressed-air worker exposure to pressures exceeding 50 pounds per square inch (p.s.i.) except in an emergency (29 CFR 1926.803(e)(5));[1] (2) require the use of the decompression values specified in decompression tables in Appendix A of the compressed-air standard for construction (29 CFR 1926.803(f)(1)); and (3) require the use of automated operational controls and a special decompression chamber (29 CFR 1926.803(g)(1)(iii) and .803(g)(1)(xvii), respectively). McNally also requested an interim order pending OSHA's decision on the application for a variance (Document ID No. OSHA-2022-0007-0002).

OSHA reviewed McNally's application for a permanent variance and interim order and determined that it was appropriately submitted in compliance with the applicable variance procedures in Section 6(d) of the Occupational Safety and Health Act of 1970

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[1] The decompression tables in Appendix A of subpart S express the maximum working pressures as pounds per square inch gauge (p.s.i.g.), with a maximum working pressure of 50 p.s.i.g. Therefore, throughout this notice, OSHA expresses the 50 p.s.i. value specified by 29 CFR 1926.803(e)(5) as 50 p.s.i.g., consistent with the terminology in Appendix A, Table 1 of subpart S.

(OSH Act; 29 U.S.C. 655) and OSHA's regulations at 29 CFR 1905.11 (variances and other relief under section 6(d)), including the requirement that the applicant inform workers and their representatives of their rights to petition the Assistant Secretary of Labor for Occupational Safety and Health for a hearing on the variance application.

OSHA reviewed the alternative procedures in McNally's application and preliminarily determined that the applicant's proposed alternatives on the whole, subject to the conditions in the request and imposed by the interim order, provide measures that are as safe and healthful as those required by the cited OSHA standards. On September 26, 2022, OSHA published a *Federal Register* notice announcing McNally's application for permanent variance, stating the preliminary determination along with the basis of that determination, and granting the interim order (87 FR 58379). OSHA requested comments on each.

OSHA did not receive any comments or other information disputing the preliminary determination that the alternatives were at least as safe as OSHA's standard, nor any objections to OSHA granting a permanent variance. Accordingly, through this notice OSHA grants a permanent variance, subject to the conditions set out in this document.

A. Background

The information that follows about McNally, its methods, and its project comes from McNally's variance application.

McNally (the applicant) is a contractor that works on complex tunnel projects using innovations in tunnel-excavation methods and is the contractor for the Shoreline Storage Tunnel Project (the project). The applicant's workers engage in the construction of tunnels using advanced shielded mechanical excavation techniques in conjunction with an earth pressure balanced tunnel boring machine (TBM). Using shielded mechanical excavation techniques, in conjunction with precast concrete tunnel liners and backfill grout, TBMs provide methods to achieve the face pressures required to maintain a

stabilized tunnel face through various geologies and isolate that pressure to the forward section (the working chamber) of the TBM.

McNally asserts that it bores tunnels using a TBM at levels below the water table through soft soils consisting of clay, silt, and sand. TBMs are capable of maintaining pressure at the tunnel face, and stabilizing existing geological conditions, through the controlled use of a mechanically driven cutter head, bulkheads within the shield, ground-treatment foam, and a screw conveyor that moves excavated material from the working chamber. The forward-most portion of the TBM is the working chamber, and this chamber is the only pressurized segment of the TBM. Within the shield, the working chamber consists of two sections: the forward working chamber and the staging chamber. The forward working chamber is immediately behind the cutter head and tunnel face. The staging chamber is behind the forward working chamber and between the man-lock door and the entry door to the forward working chamber.

The TBM has twin man-locks located between the pressurized working chamber and the non-pressurized portion of the machine. Each man-lock has two compartments. This configuration allows workers to access the man-locks for compression and decompression, and medical personnel to access the man-locks if required in an emergency.

McNally's Hyberbaric Operations Manual (HOM) for the Shoreline Storage Tunnel Project indicated that the maximum pressure to which it is likely to expose workers during project interventions for the Shoreline Storage Tunnel Project is 55 p.s.i. Therefore, to work effectively, McNally must perform hyperbaric interventions in compressed air at pressures nearly 10% higher than the maximum pressure specified by the existing OSHA standard, 29 CFR 1926.803(e)(5), which states: "No employee shall be subjected to pressure exceeding 50 p.s.i. except in emergency" (see footnote 1).

McNally employs specially trained personnel for the construction of the tunnel. To keep the machinery working effectively, McNally asserts that these workers must periodically enter the excavation working chamber of the TBM to perform hyperbaric interventions during which workers would be exposed to air pressures up to 55 p.s.i., which exceeds the maximum pressure specified by the existing OSHA standard at 29 CFR 1926.803(e)(5). These interventions consist of conducting inspections or maintenance work on the cutter-head structure and cutting tools of the TBM, such as changing replaceable cutting tools and disposable wear bars, and, in rare cases, repairing structural damage to the cutter head. These interventions are the only time that workers are exposed to compressed air. Interventions in the working chamber (the pressurized portion of the TBM) take place only after halting tunnel excavation and preparing the machine and crew for an intervention.

During interventions, workers enter the working chamber through one of the twin man-locks that open into the staging chamber. To reach the forward part of the working chamber, workers pass through a door in a bulkhead that separates the staging chamber from the forward working chamber. The man-locks and the working chamber are designed to accommodate three people, which is the maximum crew size allowed under the permanent variance. When the required decompression times are greater than work times, the twin man-locks allow for crew rotation. During crew rotation, one crew can be compressing or decompressing while the second crew is working. Therefore, the working crew always has an unoccupied man-lock at its disposal.

McNally asserts that these innovations in tunnel excavation have greatly reduced worker exposure to hazards of pressurized air work because they have eliminated the need to pressurize the entire tunnel for the project and would thereby reduce the number of workers exposed, as well as the total duration of exposure, to hyperbaric pressure during tunnel construction. These advances in technology substantially modified the

methods used by the construction industry to excavate subaqueous tunnels compared to the caisson work regulated by the current OSHA compressed-air standard for construction at 29 CFR 1926.803.

In addition to the reduced exposures resulting from the innovations in tunnel-excavation methods, McNally asserts that innovations in hyperbaric medicine and technology improve the safety of decompression from hyperbaric exposures. These procedures, however, would deviate from the decompression process that OSHA requires for construction in 29 CFR 1926.803(e)(5) and (f)(1) and the decompression tables in Appendix A of 29 CFR 1926, subpart S. Nevertheless, according to McNally, their use of decompression protocols incorporating oxygen is more efficient, effective, and safer for tunnel workers than compliance with the decompression tables specified by the existing OSHA standard.

McNally contends that the alternative safety measures included in the application provide McNally's workers with a place of employment that is at least as safe under its proposed alternatives as they would be under OSHA's compressed-air standard for construction. McNally also provided OSHA a project-specific HOM, (OSHA-2022-0007-0003) that requires specialized medical support and hyperbaric supervision to provide assistance to a team of specially trained man-lock attendants and hyperbaric or compressed-air workers to support their assertions of equivalency in worker protection.

OSHA included all of the above information in the *Federal Register* notice regarding McNally's variance application and did not receive any comments disputing any of that information, including the safety assertions made by McNally in the Variance application.

II. The Variance Application

Pursuant to the requirements of OSHA's variance regulations (29 CFR 1905.11), the applicant has certified that it notified its workers[2] of the variance modification application and request for interim order by posting, at prominent locations where it normally posts workplace notices, a summary of the application and information specifying where the workers can examine a copy of the application. In addition, the applicant has certified that it informed its workers of their right to petition the Assistant Secretary of Labor for Occupational Safety and Health for a hearing on the variance modification application.

III. OSHA History of Approval of Nearly Identical Variance Requests

OSHA has previously approved several nearly identical variances involving the same types of tunneling equipment used for similar projects (tunnel construction variances). OSHA notes that it granted five subaqueous tunnel construction permanent variances from the same provisions of OSHA's compressed-air standard (29 CFR 1926.803(e)(5), (f)(1), (g)(1)(iii), and (g)(1)(xvii)) that are the subject of the present application: (1) Impregilo, Healy, Parsons, Joint Venture (IHP JV) for the completion of the Anacostia River Tunnel in Washington, DC (80 FR 50652 (August 20, 2015)); (2) Traylor JV for the completion of the Blue Plains Tunnel in Washington, DC (80 FR 16440 (March 27, 2015)); (3) Tully/OHL USA Joint Venture for the completion of the New York Economic Development Corporation's New York Siphon Tunnel project (79 FR 29809 (May 23, 2014)); (4) Salini/Impregilo/Healy Joint Venture for the completion of the Northeast Boundary Tunnel in Washington, DC (85 FR 27767 (May 11, 2020)); and (5) Ballard Marine Construction for the completion of the Suffolk County Tunnel Project in Suffolk, New York (86 FR 5253 (January 19, 2021)). OSHA has also granted interim orders to two applicants, Ballard Marine for the Suffolk County Outfall Tunnel project in West Babylon, New York (86 FR 5253 (January 19, 2021)) and Traylor Shea Joint Venture for

[2] See the definition of "Affected employee or worker" in section VII.C. of this Notice.

the Alexandria RiverRenew Tunnel Project in Alexandria, Virginia and Washington, DC (87 FR 54536 (September 6, 2022)). The proposed alternate conditions in this notice are nearly identical to the alternate conditions of the previous permanent variances.[3] OSHA is not aware of any injuries or other safety issues that arose from work performed under these conditions in accordance with the previous variances.

IV. Applicable OSHA standard and the relevant variances

A. Variance from Paragraph (e)(5) of 29 CFR 1926.803, Prohibition of Exposure to Pressure Greater than 50 p.s.i.g. (see footnote 1)

The applicant states that it may perform hyperbaric interventions at pressures up to 55 p.s.i.g. in the working chamber of the TBM; this pressure exceeds the pressure limit of 50 p.s.i. specified for nonemergency purposes by 29 CFR 1926.803(e)(5). The TBM has twin man-locks, with each man-lock having two compartments. This configuration allows workers to access the man-locks for compression and decompression, and medical personnel to access the man-locks if required in an emergency.

TBMs are capable of maintaining pressure at the tunnel face, and stabilizing existing geological conditions, through the controlled use of a mechanically driven cutter head, bulkheads within the shield, ground-treatment foam, and a screw conveyor that moves excavated material from the working chamber. As noted earlier, the forward-most portion of the TBM is the working chamber, and this chamber is the only pressurized segment of the TBM. Within the shield, the working chamber consists of two sections: the staging chamber and the forward working chamber. The staging chamber is the section of the working chamber between the man-lock door and the entry door to the

[3] The previous tunnel construction variances allowed further deviation from OSHA standards by permitting employee exposures above 50 p.s.i. based on the composition of the soil and the amount of water that will be above the tunnel for various sections of this project. The current proposed variance includes substantively the same safeguards as the variances that OSHA granted previously even though employees will not be exposed to pressures higher than 55 p.s.i.g.

forward working chamber. The forward working chamber is immediately behind the cutter head and tunnel face.

McNally will pressurize the working chamber to the level required to maintain a stable tunnel face. Pressure in the staging chamber ranges from atmospheric (no increased pressure) to a maximum pressure equal to the pressure in the working chamber. The applicant asserts that they may have to perform interventions at pressures up to 55 p.s.i.

During interventions, workers enter the working chamber through one of the twin man-locks that open into the staging chamber. To reach the forward part of the working chamber, workers pass through a door in a bulkhead that separates the staging chamber from the forward working chamber. The maximum crew size allowed in the forward working chamber is three. At certain hyperbaric pressures (i.e., when decompression times are greater than work times), the twin man-locks allow for crew rotation. During crew rotation, one crew can be compressing or decompressing while the second crew is working. Therefore, the working crew always has an unoccupied man-lock at its disposal.

Further, McNally has developed a project-specific HOM (OSHA-2022-0007-0003) that describes in detail the hyperbaric procedures, the required medical examination used during the tunnel-construction project, the standard operating procedures and the emergency and contingency procedures. The procedures include using experienced and knowledgeable man-lock attendants who have the training and experience necessary to recognize and treat decompression illnesses and injuries. The attendants are under the direct supervision of the hyperbaric supervisor (a competent person experienced and trained in hyperbaric operations, procedures and safety) and attending physician. In addition, procedures include medical screening and review of prospective compressed-air workers (CAWs). The purpose of this screening procedure is to vet prospective CAWs

with medical conditions (e.g., deep vein thrombosis, poor vascular circulation, and muscle cramping) that could be aggravated by sitting in a cramped space (e.g., a man-lock) for extended periods, or by exposure to elevated pressures and compressed gas mixtures. A transportable recompression chamber (shuttle) is available to extract workers from the hyperbaric working chamber for emergency evacuation and medical treatment; the shuttle attaches to the topside medical lock, which is a large recompression chamber. The applicant believes that the procedures included in the HOM provide safe work conditions when interventions are necessary, including interventions above 50 p.s.i. or 50 p.s.i.g.

OSHA comprehensively reviewed the project-specific HOM and determined that the safety and health instructions and measures it specifies are appropriate, conform with the conditions in the variance, and adequately protect the safety and health of the CAWs.

B. Variance from Paragraph (f)(1) of 29 CFR 1926.803, Requirement to Use OSHA Decompression Tables

OSHA's compressed-air standard for construction requires decompression in accordance with the decompression tables in Appendix A of 29 CFR 1926, subpart S (29 CFR 1926.803(f)(1)). As an alternative to the OSHA decompression tables, the applicant proposes to use newer decompression schedules (the 1992 French Decompression Tables) that rely on staged decompression and supplement breathing air used during decompression with air or oxygen (as appropriate).[4] The applicant asserts decompression protocols using the 1992 French Decompression Tables for air or oxygen as specified by the Shoreline Storage Tunnel-specific Hyperbaric Operations Manual (HOM) are safer for tunnel workers than the decompression protocols specified in Appendix A of 29 CFR

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[4] In 1992, the French Ministry of Labour replaced the 1974 French Decompression Tables with the 1992 French Decompression Tables, which differ from OSHA's decompression tables in Appendix A by using: (1) staged decompression as opposed to continuous (linear) decompression; (2) decompression tables based on air or both air and pure oxygen; and (3) emergency tables when unexpected exposure times occur (up to 30 minutes above the maximum allowed working time).

1926, subpart S. Accordingly, the applicant commits to following the decompression procedures described in that HOM, which would require it to follow the 1992 French Decompression Tables to decompress CAWs after they exit the hyperbaric conditions in the working chamber.

Depending on the maximum working pressure and exposure times, the 1992 French Decompression Tables provide for air decompression with or without oxygen. McNally asserts that oxygen decompression has many benefits, including (1) keeping the partial pressure of nitrogen in the lungs as low as possible; (2) keeping external pressure as low as possible to reduce the formation of bubbles in the blood; (3) removing nitrogen from the lungs and arterial blood and increasing the rate of nitrogen elimination; (4) improving the quality of breathing during decompression stops so that workers are less tired and to prevent bone necrosis; (5) reducing decompression time by about 33 percent as compared to air decompression; and (6) reducing inflammation.

In addition, the project-specific HOM requires a physician, certified in hyperbaric medicine, to manage the medical condition of CAWs during hyperbaric exposures and decompression. A trained and experienced man-lock attendant also will be present during hyperbaric exposures and decompression. This man-lock attendant will operate the hyperbaric system to ensure compliance with the specified decompression table. A hyperbaric supervisor, trained in hyperbaric operations, procedures, and safety, directly oversees all hyperbaric interventions, and ensures that staff follow the procedures delineated in the HOM or by the attending physician.

C. Variance from Paragraph (g)(1)(iii) of 29 CFR 1926.803, Automatically Regulated Continuous Decompression

McNally is applying for a permanent variance from the OSHA standard at 29 CFR 1926.803(g)(1)(iii), which requires automatic controls to regulate decompression. As noted above, the applicant is committed to conducting the staged decompression

according to the 1992 French Decompression Tables under the direct control of the trained man-lock attendant and under the oversight of the hyperbaric supervisor.

Breathing air under hyperbaric conditions increases the amount of nitrogen gas dissolves in a CAW's tissues. The greater the hyperbaric pressure under these conditions and the more time spent under the increased pressure, the greater the amount of nitrogen gas dissolved in the tissues. When the pressure decreases during decompression, tissues release the dissolved nitrogen gas into the blood system, which then carries the nitrogen gas to the lungs for elimination through exhalation. Releasing hyperbaric pressure too rapidly during decompression can increase the size of the bubbles formed by nitrogen gas in the blood system, resulting in decompression illness (DCI), commonly referred to as "the bends." This description of the etiology of DCI is consistent with current scientific theory and research on the issue (see footnote 16 in this notice discussing a 1985 NIOSH report on DCI).

The 1992 French Decompression Tables, proposed for use by the applicant provide for stops during worker decompression (i.e., staged decompression) to control the release of nitrogen gas from tissues into the blood system. Studies show that staged decompression, in combination with other features of the 1992 French Decompression Tables such as the use of oxygen, result in a lower incidence of DCI than the use of automatically regulated continuous decompression.[5] In addition, the applicant asserts

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[5] See, e.g., Dr. Eric Kindwall, EP (1997), Compressed air tunneling and caisson work decompression procedures: development, problems, and solutions. *Undersea and Hyperbaric Medicine*, 24(4), pp. 337-345. This article reported 60 treated cases of DCI among 4,168 exposures between 19 and 31 p.s.i.g. over a 51-week contract period, for a DCI incidence of 1.44% for the decompression tables specified by the OSHA standard. Dr. Kindwall notes that the use of automatically regulated continuous decompression for compressed-air work was in some cases at the insistence of contractors and the union, and against the advice of the expert who calculated the decompression table and recommended using staged decompression. Dr. Kindwall then states, "Continuous decompression is inefficient and wasteful. For example, if the last stage from 4 p.s.i.g. . . . to the surface took 1h, at least half the time is spent at pressures less than 2 p.s.i.g. . . . , which provides less and less meaningful bubble suppression . . . ." In addition, Dr. Kindwall addresses the continuous-decompression protocol in the OSHA compressed-air standard for construction, noting that "[a]side from the tables for saturation diving to deep depths, no other widely used or officially approved diving decompression tables use straight line, continuous decompressions at varying rates. Stage decompression is usually the rule, since it is simpler to control."

that staged decompression administered in accordance with its HOM is at least as effective as an automatic controller in regulating the decompression process because the HOM includes a hyperbaric supervisor who directly supervises all hyperbaric interventions and ensures that the man-lock attendant, who is a competent person in the manual control of hyperbaric systems, follows the schedule specified in the decompression tables, including stops.

D. Variance from Paragraph (g)(1)(xvii) of 29 CFR 1926.803, Requirement of Special Decompression Chamber

The OSHA compressed-air standard for construction requires employers to use a special decompression chamber of sufficient size to accommodate all CAWs being decompressed at the end of the shift when total decompression time exceeds 75 minutes (see 29 CFR 1926.803(g)(1)(xvii)). Use of the special decompression chamber enables CAWs to move about and flex their joints to prevent neuromuscular problems during decompression.

Space limitations in the TBM do not allow for the installation and use of an additional special decompression lock or chamber. The applicant proposes that it be permitted to rely on the man-locks and staging chamber in lieu of adding a separate, special decompression chamber. Because only a few workers out of the entire crew are exposed to hyperbaric pressure, the man-locks (which, as noted earlier, connect directly to the working chamber) and the staging chamber are of sufficient size to accommodate all exposed workers during decompression. The applicant uses the existing man-locks, each of which adequately accommodates a three-member crew for this purpose when decompression lasts up to 75 minutes. When decompression exceeds 75 minutes, crews can open the door connecting the two compartments in each man-lock (during decompression stops) or exit the man-lock and move into the staging chamber where additional space is available. The applicant asserts that this alternative arrangement is as

effective as a special decompression chamber in that it has sufficient space for all the CAWs at the end of a shift and enables the CAWs to move about and flex their joints to prevent neuromuscular problems.

V. Decision

After reviewing the proposed alternatives, OSHA has determined that the applicant's proposed alternatives on the whole, subject to the conditions in the variance request and imposed by the permanent variance, provide measures that are as safe and healthful as those required by the cited OSHA standards addressed in section II of this notice.

In addition, OSHA has determined that each of the following alternatives are at least as effective as the specified OSHA requirements:

A. 29 CFR 1926.803(e)(5)

McNally has developed, and proposed to implement, effective alternative measures to the prohibition of using compressed air under hyperbaric conditions exceeding 50 p.s.i. The alternative measures include use of engineering and administrative controls of the hazards associated with work performed in compressed-air conditions exceeding 50 p.s.i. while engaged in the construction of a subaqueous tunnel using advance shielded mechanical-excavation techniques in conjunction with the TBM. Prior to conducting interventions in the TBM's pressurized working chamber, McNally halts tunnel excavation and prepares the machine and crew to conduct the interventions. Interventions involve inspection, maintenance, or repair of the mechanical-excavation components located in the working chamber.

B. 29 CFR 1926.803(f)(1)

The applicant has proposed to implement equally effective alternative measures to the requirement in 29 CFR 1926.803(f)(1) for compliance with OSHA's decompression tables. The HOM specifies the procedures and personnel qualifications for performing work safely during the compression and decompression phases of interventions. The

HOM also specifies the decompression tables the applicant proposes to use (the 1992 French Decompression Tables). Depending on the maximum working pressure and exposure times during the interventions, the tables provide for decompression using air, pure oxygen, or a combination of air and oxygen. The decompression tables also include delays or stops for various time intervals at different pressure levels during the transition to atmospheric pressure (i.e., staged decompression). In all cases, a physician certified in hyperbaric medicine will manage the medical condition of CAWs during decompression. In addition, a trained and experienced man-lock attendant, experienced in recognizing decompression sickness or illnesses and injuries, will be present. Of key importance, a hyperbaric supervisor, trained in hyperbaric operations, procedures, and safety, will directly supervise all hyperbaric operations to ensure compliance with the procedures delineated in the project-specific HOM or by the attending physician.

Prior to granting the five previous permanent variances to IHP JV, Traylor JV, Tully JV, Salini-Impregilo Joint Venture, and Ballard, OSHA conducted a review of the scientific literature and concluded that the alternative decompression method (i.e., the 1992 French Decompression Tables) McNally proposed would be at least as safe as the decompression tables specified by OSHA when applied by trained medical personnel under the conditions outlined in this variance application.

Some of the literature indicates that the alternative decompression method may be safer, concluding that decompression performed in accordance with these tables resulted in a lower occurrence of DCI than decompression conducted in accordance with the decompression tables specified by the standard. For example, H. L. Anderson studied the occurrence of DCI at maximum hyperbaric pressures ranging from 4 p.s.i.g. to 43 p.s.i.g. during construction of the Great Belt Tunnel in Denmark (1992-1996).[6] This project used

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[6] Anderson HL (2002). Decompression sickness during construction of the Great Belt tunnel, Denmark. *Undersea and Hyperbaric Medicine*, 29(3), pp. 172-188.

the 1992 French Decompression Tables to decompress the workers during part of the construction. Anderson observed 6 DCI cases out of 7,220 decompression events and reported that switching to the 1992 French Decompression tables reduced the DCI incidence to 0.08% compared to a previous incidence rate of 0.14%. The DCI incidence in the study by H. L. Andersen is substantially less than the DCI incidence reported for the decompression tables specified in Appendix A.

OSHA found no studies in which the DCI incidence reported for the 1992 French Decompression Tables were higher than the DCI incidence reported for the OSHA decompression tables.[7]

OSHA's experience with the previous five variances, which all incorporated nearly identical decompression plans and did not result in safety issues, also provide evidence that the alternative procedure as a whole is at least as effective for this type of tunneling project as compliance with OSHA's decompression tables. The experience of State Plans[8] that either granted variances (Nevada, Oregon and Washington)[9] or promulgated a new standard (California)[10] for hyperbaric exposures occurring during similar subaqueous tunnel-construction work, provide additional evidence of the effectiveness of this alternative procedure.

C. 29 CFR 1926.803(g)(1)(iii)

The applicant developed, and proposed to implement, an equally effective alternative to 29 CFR 1926.803(g)(1)(iii), which requires the use of automatic controllers that

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[7] Le Péchon JC, Barre P, Baud JP, Ollivier F (September 1996). Compressed air work - French Tables 1992 - operational results. *JCLP Hyperbarie Paris, Centre Medical Subaquatique Interentreprise, Marseille: Communication a l'EUBS*, pp. 1-5 (see Ex. OSHA-2012-0036-0005).

[8] Under Section 18 of the OSH Act, Congress expressly provides that States and U.S. territories may adopt, with Federal approval, a plan for the development and enforcement of occupational safety and health standards. OSHA refers to such States and territories as ''State Plans.'' Occupational safety and health standards developed by State Plans must be at least as effective in providing safe and healthful employment and places of employment as the Federal standards (29 U.S.C. 667).

[9] These state variances are available in the docket for the 2015 Traylor JV variance: Exs. OSHA-2012-0035-0006 (Nevada), OSHA-2012-0035-0005 (Oregon), and OSHA-2012-0035-0004 (Washington).

[10] See California Code of Regulations, Title 8, Subchapter 7, Group 26, Article 154, available at *http://www.dir.ca.gov/title8/sb7g26a154.html.*

continuously decrease pressure to achieve decompression in accordance with the tables specified by the standard. The applicant's alternative includes using the 1992 French Decompression Tables for guiding staged decompression to achieve lower occurrences of DCI, using a trained and competent attendant for implementing appropriate hyperbaric entry and exit procedures, and providing a competent - and attending physician certified in hyperbaric medicine to oversee all hyperbaric operations.

In reaching this preliminary conclusion, OSHA again notes the experience of previous nearly identical tunneling variances, the experiences of State Plan States, and a review of the literature and other information noted earlier.

D. 29 CFR 1926.803(g)(1)(xvii)

The applicant developed, and proposed to implement, an effective alternative to the use of the special decompression chamber required by 29 CFR 1926.803(g)(1)(xvii). The TBM's man-lock and working chamber appear to satisfy all of the conditions of the special decompression chamber, including that they provide sufficient space for the maximum crew of three CAWs to stand up and move around, and safely accommodate decompression times exceeding 75 minutes. Therefore, again noting OSHA's previous experience with nearly identical variances including the same alternative, OSHA preliminarily determined that the TBM's man-lock and working chamber function as effectively as the special decompression chamber required by the standard.

Based on a review of available evidence, the experience of State Plans that either granted variances (Nevada, Oregon, and Washington)[11] or promulgated a new standard (California)[12] for hyperbaric exposures occurring during similar subaqueous tunnel-

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[11]These state variances are available in the application docket for the original Traylor variance application: Exs. OSHA-2012-0035-0006 (Nevada), OSHA-2012-0035-0007 (Oregon), and OSHA-2012-0035-0008 (Washington).

[12]See California Code of Regulations, Title 8, Subchapter 7, Group 26, Article 154, available at http://www.dir.ca.gov/title8/sb7g26a154.html.

construction work, and the information provided in the applicant's variance application, OSHA is granting the permanent variance.

Pursuant to Section 6(d) of the Occupational Safety and Health Act of 1970 (29 U.S.C. 655), and based on the record discussed above, the agency finds that when the McNally complies with the conditions of the following order, the working conditions of the McNally's workers are at least as safe and healthful as if it complied with the working conditions specified by paragraphs (e)(5), (f)(1), (g)(1)(iii), and (g)(1)(xvii) of 29 CFR 1926.803. Therefore, McNally must: (1) comply with the conditions listed below under "Conditions Specified for the Permanent Variance" for the period between the date of this notice and completion of the Shoreline Storage Tunnel Project; (2) comply fully with all other applicable provisions of 29 CFR part 1926; and (3) provide a copy of this *Federal Register* notice to all employees affected by the conditions, including the affected employees of other employers, using the same means it used to inform these employees of the application for a permanent variance. Additionally, this order will remain in effect until one of the following conditions occurs: (1) completion of the Shoreline Storage Tunnel Project; or (2) OSHA modifies or revokes this final order in accordance with 29 CFR 1905.13.

VI. Description of the Conditions Specified for the Permanent Variance

The conditions for the variance are set out in the Order at the end of this document. This section provides additional detail regarding the conditions in the Order.

Condition A: Scope

The scope of the permanent variance limits coverage to the work situations specified under this condition. Clearly defining the scope of the permanent variance provides McNally, their employees, potential future applicants, other stakeholders, the public and OSHA with necessary information regarding the work situations in which the permanent variance applies. To the extent that McNally exceeds the defined scope of this variance,

it will be required to comply with OSHA's standards. This permanent variance applies only to McNally, and only to the remainder of the Cleveland Storage Tunnel Project.

Condition B: List of Abbreviations

Condition B defines a number of abbreviations used in the permanent variance. OSHA believes that defining these abbreviations serves to clarify and standardize their usage, thereby enhancing the applicant's and their employees' understanding of the conditions specified by the permanent variance.

Condition C: Definitions

Condition C defines a series of terms, mostly technical terms, used in the permanent variance to standardize and clarify their meaning. Defining these terms serves to enhance the applicant's and their employees' understanding of the conditions specified by the permanent variance.

Condition D: Safety and Health Practices

This condition requires the applicant to develop and submit to OSHA an HOM specific to the Shoreline Storage Tunnel at least six months before using the TBM, proof that the TBM's hyperbaric chambers have been designed, fabricated, inspected, tested marked, and stamped in accordance with the requirements for ASME PVHO-1-2019 (or the most recent edition of *Safety Standards for Pressure Vessels for Human Occupancy*). These requirements ensure that the applicant develops hyperbaric safety and health procedures suitable for the project.

The submission of the HOM to OSHA, which McNally has already completed, enables OSHA to determine that the specific safety and health instructions and measures it specifies are appropriate to the field conditions of the tunnel (including expected geological conditions), conform to the conditions of the variance, and adequately protect the safety and health of the CAWs. It also facilitates OSHA's ability to ensure that the

applicant is complying with these instructions and measures. The requirement for proof of compliance with ASME PVHO-1-2019 is intended to ensure that the equipment is structurally sound and capable of performing to protect the safety of the employees exposed to hyperbaric pressure.

Additionally, the condition includes a series of related hazard prevention and control requirements and methods (e.g., decompression tables, job hazard analysis (JHA), operations and inspections checklists, incident investigation, and recording and notification to OSHA of recordable hyperbaric injuries and illnesses) designed to ensure the continued effective functioning of the hyperbaric equipment and operating system.

Condition E: Communication

Condition E requires the applicant to develop and implement an effective system of information sharing and communication. Effective information sharing and communication ensures that affected workers receive updated information regarding any safety-related hazards and incidents, and corrective actions taken, prior to the start of each shift. The condition also requires McNally to ensure that reliable means of emergency communications are available and maintained for affected workers and support personnel during hyperbaric operations. Availability of such reliable means of communications enables affected workers and support personnel to respond quickly and effectively to hazardous conditions or emergencies that may develop during TBM operations.

Condition F: Worker Qualification and Training

This condition requires the applicant to develop and implement an effective qualification and training program for affected workers. The condition specifies the factors that an affected worker must know to perform safely during hyperbaric operations, including how to enter, work in, and exit from hyperbaric conditions under both normal and emergency conditions. Having well-trained and qualified workers

performing hyperbaric intervention work ensures that they recognize, and respond appropriately to, hyperbaric safety and health hazards. These qualification and training requirements enable affected workers to cope effectively with emergencies, as well as the discomfort and physiological effects of hyperbaric exposure, thereby preventing worker injury, illness, and fatalities.

Paragraph (2)(e) of this condition also requires the applicant to provide affected workers with information they can use to contact the appropriate healthcare professionals if they believe they are developing hyperbaric-related health effects. This requirement provides for early intervention and treatment of DCI and other health effects resulting from hyperbaric exposure, thereby reducing the potential severity of these effects.

Condition G: Inspections, Tests, and Accident Prevention

Condition G requires the applicant to develop, implement, and operate a program of frequent and regular inspections of the TBM's hyperbaric equipment and support systems, and associated work areas. This condition helps to ensure the safe operation and physical integrity of the equipment and work areas necessary to conduct hyperbaric operations. The condition also enhances worker safety by reducing the risk of hyperbaric-related emergencies.

Paragraph (3) of this condition requires the applicant to document tests, inspections, corrective actions, and repairs involving the TBM, and maintain these documents at the job site for the duration of the job. This requirement provides the applicant with information needed to schedule tests and inspections to ensure the continued safe operation of the equipment and systems, and to determine that the actions taken to correct defects in hyperbaric equipment and systems were appropriate, prior to returning them to service.

Condition H: Compression and Decompression

This condition requires the applicant to consult with a designated medical advisor regarding special compression or decompression procedures appropriate for any unacclimated CAW and then implement the procedures recommended by the medical advisor. This provision ensures that the applicant consults with the medical advisor, and involves the medical advisor in the evaluation, development, and implementation of compression or decompression protocols appropriate for any CAW requiring acclimation to the hyperbaric conditions encountered during TBM operations. Accordingly, CAWs requiring acclimation have an opportunity to acclimate prior to exposure to these hyperbaric conditions. OSHA believes this condition will prevent or reduce adverse reactions among CAWs to the effects of compression or decompression associated with the intervention work they perform in the TBM.

Condition I: Recordkeeping

Under OSHA's existing recordkeeping requirements in 29 CFR part 1904 regarding Recording and Reporting Occupational Injuries and Illnesses, the employer must maintain a record of any recordable injury, illness, or fatality (as defined by 29 CFR part 1904) resulting from exposure of an employee to hyperbaric conditions by completing the OSHA Form 301 Incident Report and OSHA Form 300 Log of Work-Related Injuries and Illnesses. The applicant did not seek a variance from this standard and therefore McNally must comply fully with those requirements.

Examples of important information to include on the OSHA Form 301 Injury and Illness Incident Report (along with the corresponding question on the form) are:

Q14

- the task performed;
- the composition of the gas mixture (e.g., air or oxygen);
- an estimate of the CAW's workload;
- the maximum working pressure;

- temperature in the work and decompression environments;
- unusual occurrences, if any, during the task or decompression

Q15

- time of symptom onset;
- duration between decompression and onset of symptoms

Q16

- type and duration of symptoms;
- a medical summary of the illness or injury

Q17

- duration of the hyperbaric intervention;
- possible contributing factors;
- the number of prior interventions completed by the injured or ill CAW; and the pressure to which the CAW was exposed during those interventions.[13]

Condition I adds additional reporting responsibilities, beyond those already required by the OSHA rule. McNally is required to maintain records of specific factors associated with each hyperbaric intervention. The information gathered and recorded under this provision, in concert with the information provided under Condition J (using OSHA's Form 301 Injury and Illness Incident Report to investigate and record hyperbaric recordable injuries as defined by 29 CFR 1904.4, 1904.7, and 1904.8 - .12), enables McNally and OSHA to assess the effectiveness of the permanent variance in preventing DCI and other hyperbaric-related effects.

Condition J: Notifications

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[13] See 29 CFR 1904 Recording and Reporting Occupational Injuries and Illnesses *(http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9631)*; recordkeeping forms and instructions *(http://www.osha.gov/recordkeeping/RKform300pkg-fillable-enabled.pdf*); and OSHA Recordkeeping Handbook *(http://www.osha.gov/recordkeeping/handbook/index.html*).

Under the notification condition, the applicant is required, within specified periods of time, to notify OSHA of: (1) any recordable injury, illness, in-patient hospitalization, amputation, loss of an eye, or fatality that occurs as a result of hyperbaric exposures during TBM operations; (2) provide OSHA a copy of the hyperbaric exposures incident investigation report (using OSHA Form 301 Injury and Illness Incident Report) of these events within 24 hours of the incident; (3) include on OSHA Form 301 Injury and Illness Incident Report information on the hyperbaric conditions associated with the recordable injury or illness, the root-cause determination, and preventive and corrective actions identified and implemented; (4) provide the certification that affected workers were informed of the incident and the results of the incident investigation; (5) notify OSHA's Office of Technical Programs and Coordination Activities (OTPCA) and the Cleveland OSHA Area Office within 15 working days should the applicant need to revise the HOM to accommodate changes in its compressed-air operations that affect McNally's ability to comply with the conditions of the modified permanent variance; and (6) provide OTPCA and the Cleveland Ohio OSHA Area Office, at the end of the project, with a report evaluating the effectiveness of the decompression tables.

It should be noted that the requirement for completing and submitting the hyperbaric exposure-related (recordable) incident investigation report (OSHA 301 Injury and Illness Incident Report) is more restrictive than the current recordkeeping requirement of completing OSHA Form 301 Injury and Illness Incident Report within 7 calendar days of the incident (1904.29(b)(3)). This modified, more stringent incident investigation and reporting requirement is restricted to intervention-related hyperbaric (recordable) incidents only. Providing rapid notification to OSHA is essential because time is a critical element in OSHA's ability to determine the continued effectiveness of the variance conditions in preventing hyperbaric incidents, and the applicant's identification and implementation of appropriate corrective and preventive actions.

Further, these notification requirements also enable the applicant, its employees, and OSHA to assess the effectiveness of the modified permanent variance in providing the requisite level of safety to the applicant's workers and, based on this assessment, whether to revise or revoke the conditions of the modified permanent variance. Timely notification permits OSHA to take whatever action may be necessary and appropriate to prevent possible further injuries and illnesses. Providing notification to employees informs them of the precautions taken by the applicant to prevent similar incidents in the future.

Additionally, this condition requires the applicant to notify OSHA if it ceases to do business, has a new address or location for the main office, or transfers the operations covered by the modified permanent variance to a successor company. In addition, the condition specifies that the transfer of the modified permanent variance to a successor company must be approved by OSHA. These requirements allow OSHA to communicate effectively with the applicant regarding the status of the modified permanent variance and expedite the agency's administration and enforcement of the modified permanent variance. Stipulating that an applicant is required to have OSHA's approval to transfer a variance to a successor company provides assurance that the successor company has knowledge of, and will comply with, the conditions specified by modified permanent variance, thereby ensuring the safety of workers involved in performing the operations covered by the modified permanent variance.

VII. Order

As of the effective date of this final order, OSHA is revoking the interim order granted to the employer on September 26, 2022 and replacing it with a permanent variance order. Note that there are not any substantive changes in the conditions between interim order and the final order.

OSHA issues this final order authorizing McNally to comply with the following conditions instead of complying with the requirements of 29 CFR 1926.803(e)(5), (f)(1), (g)(1)(iii), and (g)(1)(xvii). These conditions are:

A. Scope

The permanent variance applies only when McNally stops the tunnel-boring work, pressurizes the working chamber, and the CAWs either enter the working chamber to perform an intervention (i.e., inspection, maintain, or repair the mechanical-excavation components), or exit the working chamber after performing interventions.

The permanent variance applies only to work:

1. That occurs in conjunction with construction of the Shoreline Storage Tunnel Project in Cleveland, Ohio, a subaqueous tunnel constructed using advanced shielded mechanical-excavation techniques and involving operation of an TBM;
2. In the TBM's forward section (the working chamber) and associated hyperbaric chambers used to pressurize and decompress employees entering and exiting the working chamber; and
3. Performed in compliance with all applicable provisions of 29 CFR 1926 except for the requirement specified by 29 CFR 1926.803(e)(5), (f)(1), (g)(1)(iii), and (g)(1)(xvii).
4. This order will remain in effect until one of the following conditions occurs: (1) completion of the Shoreline Storage Tunnel Project; or (2) OSHA modifies or revokes this final order in accordance with 29 CFR 1905.13.

B. List of Abbreviations

Abbreviations used throughout this permanent variance include the following:

1. COAO – Cleveland, Ohio OSHA Area Office
2. CAW – Compressed-air worker
3. CFR – Code of Federal Regulations

4. DCI – Decompression Illness
5. TBM – Earth Pressure Balanced Moving Tunnel Boring Machine
6. HOM – Hyperbaric Operations and Safety Manual
7. JHA – Job hazard analysis
8. OSHA – Occupational Safety and Health Administration
9. OTPCA – Office of Technical Programs and Coordination Activities

C. Definitions

The following definitions apply to this permanent variance. These definitions supplement the definitions in McNally's project-specific HOM.

1. *Affected employee or worker* – an employee or worker who is affected by the conditions of this permanent variance, or any one of his or her authorized representatives. The term "employee" has the meaning defined and used under the Occupational Safety and Health Act of 1970 (29 U.S.C. 651 et seq.)
2. *Atmospheric pressure* – the pressure of air at sea level, generally 14.7 p.s.i.a., 1 atmosphere absolute, or 0 p.s.i.g.
3. *Compressed-air worker* – an individual who is specially trained and medically qualified to perform work in a pressurized environment while breathing air at pressures not exceeding 55 p.s.i.g.
4. *Competent person* – an individual who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.[14]
5. *Decompression illness (also called decompression sickness or the bends)* – an illness caused by gas bubbles appearing in body compartments due to a reduction

[14]Adapted from 29 CFR 1926.32(f).

in ambient pressure. Examples of symptoms of decompression illness include (but are not limited to): joint pain (also known as the "bends" for agonizing pain or the "niggles" for slight pain); areas of bone destruction (termed "dysbaric osteonecrosis"); skin disorders (such as cutis marmorata, which causes a pink marbling of the skin); spinal cord and brain disorders (such as stroke, paralysis, paresthesia, and bladder dysfunction); cardiopulmonary disorders, such as shortness of breath; and arterial gas embolism (gas bubbles in the arteries that block blood flow).[15]

Note: Health effects associated with hyperbaric intervention, but not considered symptoms of DCI, can include: barotrauma (direct damage to air-containing cavities in the body such as ears, sinuses, and lungs); nitrogen narcosis (reversible alteration in consciousness that may occur in hyperbaric environments and caused by the anesthetic effect of certain gases at high pressure); and oxygen toxicity (a central nervous system condition resulting from the harmful effects of breathing molecular oxygen (O_2) at elevated partial pressures).

6. *Diver Medical Technician* – Member of the dive team who is experienced in first aid.
7. *Earth Pressure Balanced Moving Tunnel Boring Machine* – the machinery used to excavate the tunnel.
8. *Hot work* – any activity performed in a hazardous location that may introduce an ignition source into a potentially flammable atmosphere.[16]
9. *Hyperbaric* – at a higher pressure than atmospheric pressure.

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[15]See Appendix 10 of "A Guide to the Work in Compressed Air Regulations 1996," published by the United Kingdom Health and Safety Executive and available from NIOSH at http://www.cdc.gov/niosh/docket/archive/pdfs/NIOSH-254/compReg1996.pdf.

[16]Also see 29 CFR 1910.146(b).

10. *Hyperbaric intervention* – a term that describes the process of stopping the TBM and preparing and executing work under hyperbaric pressure in the working chamber for the purpose of inspecting, replacing, or repairing cutting tools and/or the cutterhead structure.
11. *Hyperbaric Operations Manual* – a detailed, project-specific health and safety plan developed and implemented by the McNally for working in compressed air during the Shoreline Storage Tunnel.
12. *Job hazard analysis* – an evaluation of tasks or operations to identify potential hazards and to determine the necessary controls.
13. *Man lock* – an enclosed space capable of pressurization, and used for compressing or decompressing any employee or material when either is passing into or out of a working chamber.
14. *Medical Advisor* – medical professional experience in the physical requirements of compressed air work and the treatment of decompression illness.
15. *Pressure* – a force acting on a unit area; usually expressed as pounds per square inch (p.s.i.).
16. *p.s.i.* – pounds per square inch, a common unit of measurement of pressure; a pressure given in p.s.i. corresponds to absolute pressure.
17. *p.s.i.a* – pounds per square inch absolute, or absolute pressure, is the sum of the atmospheric pressure and gauge pressure. At sea level, atmospheric pressure is approximately 14.7 p.s.i. Adding 14.7 to a pressure expressed in units of p.s.i.g. will yield the absolute pressure, expressed as p.s.i.a.
18. *p.s.i.g.* – pounds per square inch gauge, a common unit of pressure; pressure expressed as p.s.i.g. corresponds to pressure relative to atmospheric pressure. At sea level, atmospheric pressure is approximately 14.7 p.s.i. Subtracting 14.7 from

a pressure expressed in units of p.s.i.a. yields the gauge pressure, expressed as p.s.i.g.

19. *Qualified person* – an individual who, by possession of a recognized degree, certificate, or professional standing, or who, by extensive knowledge, training, and experience, successfully demonstrates an ability to solve or resolve problems relating to the subject matter, the work, or the project.[17]
20. *Working chamber* – an enclosed space in the TBM in which CAWs perform interventions, and which is accessible only through a man lock.

D. Safety and Health Practices

1. McNally must implement the project-specific HOM submitted to OSHA as part of the variance application (see OSHA-2022-0007-0003). The HOM provides the minimum requirements regarding expected safety and health hazards (including anticipated geological conditions) and hyperbaric exposures during the tunnel-construction project.
2. McNally must demonstrate that the TBM on the project is designed, fabricated, inspected, tested, marked and stamped in accordance with the requirements of ASME PVHO-1.2019 (or most recent edition of *Safety Standards for Pressure Vessels for Human Occupancy*) for the TBM's hyperbaric chambers.
3. McNally must implement the safety and health instructions included in the manufacturer's operations manuals for the TBM, and the safety and health instructions provided by the manufacturer for the operation of decompression equipment.
4. McNally must ensure that there are no exposures to pressures greater than 55 p.s.i.g.

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[17]Adapted from 29 CFR 1926.32(m).

5. McNally must ensure that air or oxygen as the only breathing gas in the working chamber.
6. McNally must follow the 1992 French Decompression Tables for air, air-oxygen, and oxygen decompression specified in the HOM, specifically the tables titled "French Regulation Air Standard Tables."
7. McNally must equip man-locks used by their employees with an oxygen-delivery system as specified by the HOM. McNally is prohibited from storing in the tunnel any oxygen or other compressed gases used in conjunction with hyperbaric work.
8. Workers performing hot work under hyperbaric conditions must use flame-retardant personal protective equipment and clothing.
9. In hyperbaric work areas, McNally must maintain an adequate fire-suppression system approved for hyperbaric work areas.
10. McNally must develop and implement one or more Job Hazard Analyses (JHA) for work in the hyperbaric work areas, and review, periodically and as necessary (e.g., after making changes to a planned intervention that affects their operation), the contents of the JHAs with affected employees. The JHAs must include all the job functions that the risk assessment[18] indicates are essential to prevent injury or illness.
11. McNally must develop a set of checklists to guide compressed-air work and ensure that employees follow the procedures required by this permanent variance (including all procedures required by the HOM, which this permanent variance incorporates by reference). The checklists must include all steps and equipment

[18]See ANSI/AIHA Z10-2012, American National Standard for Occupational Health and Safety Management Systems, for reference.

functions that the risk assessment indicates are essential to prevent injury or illness during compressed-air work.

12. McNally must ensure that the safety and health provisions of this project-specific HOM adequately protect the workers of all contractors and subcontractors involved in hyperbaric operations for the project to which the HOM applies.[19]

E. Communication

1. Prior to beginning a shift, McNally must implement a system that informs workers exposed to hyperbaric conditions of any hazardous occurrences or conditions that might affect their safety, including hyperbaric incidents, gas releases, equipment failures, earth or rockslides, cave-ins, flooding, fires, or explosions.
2. McNally must provide a power-assisted means of communication among affected workers and support personnel in hyperbaric conditions where unassisted voice communication is inadequate.
    a) McNally must use an independent power supply for powered communication systems, and these systems must operate such that use or disruption of any one phone or signal location will not disrupt the operation of the system from any other location.
    b) McNally must test communication systems at the start of each shift and as necessary thereafter to ensure proper operation.

F. Worker Qualification and Training

McNally must:

[19]See ANSI/ASSE A10.33-2011, American National Standard for Construction and Demolition Operations – Safety and Health Program Requirements for Multi-Employer Projects, for reference.

1. Ensure that each affected worker receives effective training on how to safely enter, work in, exit from, and undertake emergency evacuation or rescue from, hyperbaric conditions, and document this training.
2. Provide effective instruction, before beginning hyperbaric operations, to each worker who performs work, or controls the exposure of others, in hyperbaric conditions, and document this instruction. The instruction must include topics such as:
    a) The physics and physiology of hyperbaric work;
    b) Recognition of pressure-related injuries;
    c) Information on the causes and recognition of the signs and symptoms associated with decompression illness, and other hyperbaric intervention-related health effects (e.g., barotrauma, nitrogen narcosis, and oxygen toxicity).
    d) How to avoid discomfort during compression and decompression; and
    e) Information the workers can use to contact the appropriate healthcare professionals should the workers have concerns that they may be experiencing adverse health effects from hyperbaric exposure; and
    f) Procedures and requirements applicable to the employee in the project-specific HOM.
3. Repeat the instruction specified in paragraph (2) of this condition periodically and as necessary (e.g., after making changes to their hyperbaric operations).
4. When conducting training for their hyperbaric workers, make this training available to OSHA personnel and notify OTPCA the Cleveland, Ohio OSHA Area Office before the training takes place.

G. Inspections, Tests, and Accident Prevention

1. McNally must initiate and maintain a program of frequent and regular inspections of the TBM's hyperbaric equipment and support systems (such as temperature control, illumination, ventilation, and fire-prevention and fire-suppression systems), and hyperbaric work areas, as required under 29 CFR 1926.20(b)(2), including:
    a) Developing a set of checklists to be used by a competent person in conducting weekly inspections of hyperbaric equipment and work areas; and
    b) Ensuring that a competent person conducts daily visual checks, as well as weekly inspections of the TBM.
2. Remove from service any equipment that constitutes a safety hazard until it corrects the hazardous condition and has the correction approved by a qualified person.
3. McNally must maintain records of all tests and inspections of the TBM, as well as associated corrective actions and repairs, at the job site for the duration of the job.

H. Compression and Decompression

McNally must consult with their attending physician concerning the need for special compression or decompression exposures appropriate for CAWs not acclimated to hyperbaric exposure.

I. Recordkeeping

In addition to completing OSHA Form 301 Injury and Illness Incident Report and OSHA Form 300 Log of Work-Related Injuries and Illnesses, McNally must maintain records of:

1. The date, times (e.g., time compression started, time spent compressing, time performing intervention, time spent decompressing), and pressure for each hyperbaric intervention.
2. The names of all supervisors and DMTs involved for each intervention.

3. The name of each individual worker exposed to hyperbaric pressure and the decompression protocols and results for each worker.
4. The total number of interventions and the amount of hyperbaric work time at each pressure.
5. The results of the post-intervention physical assessment of each CAW for signs and symptoms of decompression illness, barotrauma, nitrogen narcosis, oxygen toxicity or other health effects associated with work in compressed air for each hyperbaric intervention.

J. Notifications

1. To assist OSHA in administering the conditions specified herein, the McNally must:
   a) Notify the OTPCA and the Cleveland Ohio OSHA Area Office of any recordable injury, illness, or fatality (by submitting the completed OSHA's Form 301 Injury and Illness Incident Report form)[20] resulting from exposure of an employee to hyperbaric conditions, including those exposures that do not require recompression treatment (e.g., nitrogen narcosis, oxygen toxicity, barotrauma), but still meet the recordable injury or illness criteria of 29 CFR 1904. The employer shall provide the notification within 8 hours of the incident or 8 hours after becoming aware of a recordable injury, illness, or fatality, and submit a copy of the incident investigation (OSHA's Form 301 Injury and Illness Injury Reporting Form) within 24 hours of the incident or 24 hours after becoming aware of a recordable injury, illness, or fatality. In addition to the information required by the OSHA's Form 301 Injury and

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[20]See 29 CFR 1904 (Recording and Reporting Occupational Injuries and Illnesses) (*http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9631*); recordkeeping forms and instructions (*http://www.osha.gov/recordkeeping/RKform300pkg-fillable-enabled.pdf*); and the OSHA Recordkeeping Handbook (*http://www.osha.gov/recordkeeping/handbook/index.html*).

Illness Injury Reporting Form, the incident-investigation report must include a root-cause determination, and the preventive and corrective actions identified and implemented.

b) Provide certification within 15 days of the incident that the employer informed affected workers of the incident and the results of the incident investigation (including the root-cause determination and preventive and corrective actions identified and implemented).

c) Notify the OTPCA and the Cleveland Ohio OSHA Area Office within 15 working days in writing of any change in the compressed-air operations that affects the employer's ability to comply with the conditions specified herein.

d) Upon completion of the Shoreline Storage Tunnel, evaluate the effectiveness of the decompression tables used throughout the project, and provide a written report of this evaluation to the OTPCA and the Cleveland Ohio OSHA Area Office.

Note: The evaluation report is to contain summaries of: (1) the number, dates, durations, and pressures of the hyperbaric interventions completed; (2) decompression protocols implemented (including composition of gas mixtures (air and/or oxygen), and the results achieved; (3) the total number of interventions and the number of hyperbaric incidents (decompression illnesses and/or health effects associated with hyperbaric interventions as recorded on OSHA's Form 301 Injury and Illness Incident Report and OSHA's Form 300 Log of Work-Related Injuries and Illnesses, and relevant medical diagnoses and treating physicians' opinions); and (4) root causes of any hyperbaric incidents, and preventive and corrective actions identified and implemented.

e) To assist OSHA in administering the conditions specified herein, inform the OTPCA and the Cleveland Ohio OSHA Area Office as soon as possible after it has knowledge that it will:

i. Cease to do business;

ii. Change the location and address of the main office for managing the tunneling operations specified herein; or

iii. Transfer the operations specified herein to a successor company.

f) Notify all affected employees of this permanent variance by the same means required to inform them of the application for a variance.

g) This permanent variance cannot be transferred to a successor company without OSHA approval.

OSHA hereby grants a permanent variance to McNally to the provisions of 29 CFR 1926.803 outlined in this notice.

VIII. Authority and Signature

James S. Frederick, Deputy Assistant Secretary of Labor for Occupational Safety and Health, 200 Constitution Avenue, NW, Washington, DC 20210, authorized the preparation of this notice. Accordingly, the agency is issuing this notice pursuant to 29 U.S.C. 655(d), Secretary of Labor's Order No. 8-2020 (85 FR 58393, Sept. 18, 2020), and 29 CFR 1905.11.

Signed at Washington, DC, on March 6, 2023.

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James S. Frederick,
Deputy Assistant Secretary of Labor for Occupational Safety and Health.

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